Effects of modeled microgravity on expression profiles of micro RNA in human lymphoblastoid cells

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Abstract

Among space radiation and other environmental factors, microgravity or an altered gravity is undoubtedly the most significant stress experienced by living organisms during flight. In comparison to the static 1g, microgravity has been shown to alter global gene expression patterns and protein levels in cultured cells or animals. Micro RNA (miRNA) has recently emerged as an important regulator of gene expression, possibly regulating as many as one-third of all human genes. miRNA represents a class of single-stranded noncoding regulatory RNA molecules (~ 22 nt) that control gene expressions by inhibiting the translation of mRNA to proteins. However, very little is known on the effect of altered gravity on miRNA expression. We hypothesized that the miRNA expression profile will be altered in zero gravity resulting in regulation of the gene expression and functional changes of the cells. To test this hypothesis, we cultured TK6 human lymphoblastoid cells in Synthecon's Rotary cell culture system **(**bioreactors) for 72 h either in the rotating (10 rpm) to model the microgravity in space or in the static condition. The cell viability was determined before and after culturing the cells in the bioreactor using both trypan blue and guava via count. Expressions of a panel of 352 human miRNA were analyzed using the miRNA PCRarray. Out of 352 miRNAs, expressions of 75 were significantly altered by a change of greater than 1.5 folds and seven miRNAs were altered by a fold change greater than 2 under the rotating culture condition. Among these seven, miR-545 and miR-517a were down regulated by 2 folds, whereas miR-150, miR-302a, miR-139-3p, miR-515-3p and miR-564 were up regulated by 2 to 8 folds. To confirm whether this altered miRNA expression correlates with gene expression and functional changes of the cells, we performed DNA Illumina Microarray Analysis and validated the related genes using q-RT PCR.